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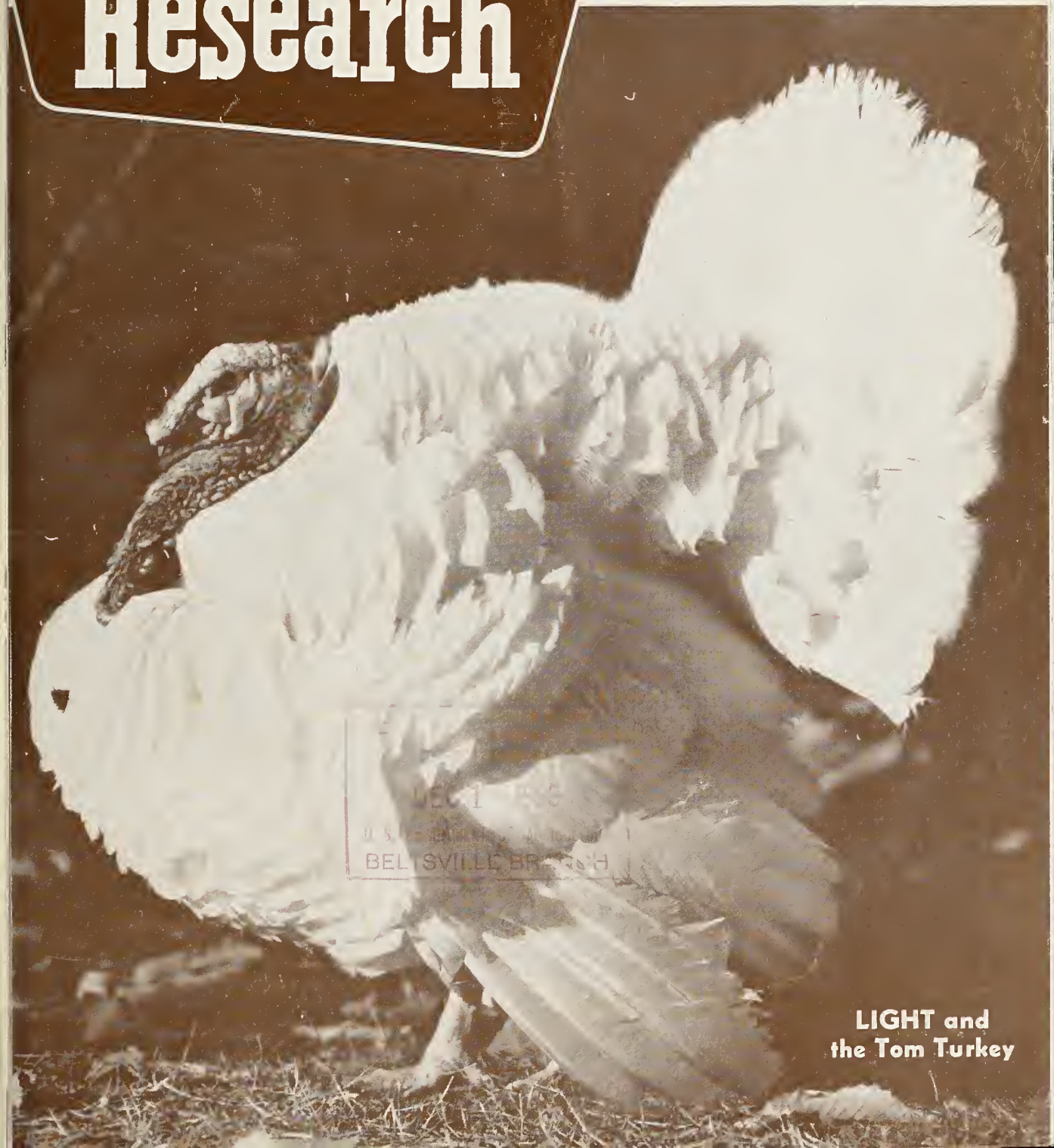
# AGRICULTURAL Research

NOVEMBER 1953



BELTSVILLE BR

**LIGHT and the Tom Turkey**

AGRICULTURAL
# Research

VOL. 2—NOVEMBER 1953—NO. 5

THOMAS McGINTY—EDITOR
JOSEPH SILBAUGH—ASS'T EDITOR

## Freedom to think

We often picture the old-time scientist as an independent seeker after truth, working under a system of scientific free enterprise that let him experiment undisturbed. His sponsors rarely pried into his methods, questioned his objectives, or asked him to justify his research. Though his funds and facilities were limited, at least he was left alone.

This is no doubt an idealized portrait, but it expresses the common conviction—well supported by fact—that great scientific achievements in the past were the result of individual, meditative thought.

Research today has a different environment. Just as science pervades everyday living, so world affairs intrude into the laboratory. Our highly organized and coordinated scientific effort—characterized by "team research," "advisory committees," "regional projects," and other innovations—hardly fits the classical model. And it makes demands of modern researchers that were unheard of in an earlier day.

The new methods we've developed for doing research, and putting its findings into use, have well-recognized advantages. One result is that the general public—now science's chief patron—benefits as never before from the work of laboratories and experiment stations. Yet it's also true that our research system has burdened the scientist with a variety of administrative chores that are not in themselves scientifically productive. Moreover, like many other complex systems, it has some built-in brakes on individual initiative.

In science, as elsewhere, we ought to guard against the system's subjugating the man. Efforts toward this end should be and are being made. We know that major contributions to knowledge still depend on individuals—on their intelligence, imagination, and inspiration. As the classical scientist might remind us, ideas that change man's view of the world and provide the keys to new progress don't often emerge in conferences and cannot be planned in advance. They come from individuals with the ability and opportunity to think along new lines.

Developing scientists with a capacity for creative investigation—and giving them the freedom to think—is vital for the continued success of agricultural and all other research.

AGRICULTURAL RESEARCH ADMINISTRATION
United States Department of Agriculture

FINE FEATHERS of strutting Beltsville Small White gobbler are new set, grown in molting season. Light's effect on turkey molt and fertility is described on page 6. *USDA photo by Stenhouse.*

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*Agricultural Research* is issued monthly by the Agricultural Research Administration, United States Department of Agriculture, Washington 25, D. C. The printing of this periodical was approved by the Director of the Bureau of the Budget on August 19, 1952. Yearly subscription rate is $1 in the United States and countries of the Postal Union, $1.35 in other countries. Single copies are 15 cents each. Orders and remittances should be sent directly to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

# Improved processing with SRRL's Cotton Opener

Modern cotton-mill equipment is hard to beat—it has about 200 years of engineering behind it. But we now have a machine that does one mill job better. It's a simple but highly effective device for opening, or fluffing up, baled cotton to make it ready for spinning.

Known as the SRRL cotton opener, it cuts mill costs and helps improve cotton products. It was developed by R. A. Rusca, R. C. Young, and coworkers at the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory.

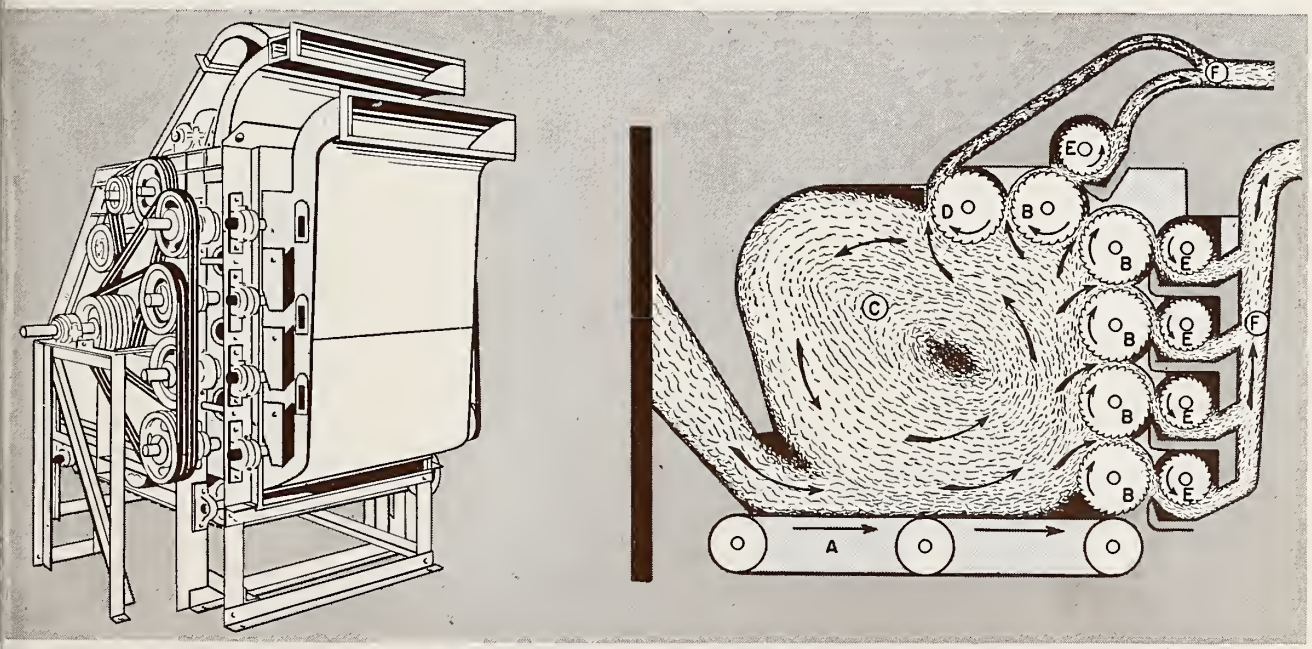
This machine has been in limited commercial use since 1951. About 40 openers are now in operation, and the number is steadily growing. By making cotton easier to clean, and reducing loss of spinnable lint, they save mills 50 cents to $1 per bale of cotton opened and result in stronger, better quality yarn. In the average mill, an opener can pay for itself (cost: about $10,000) during its first 12 months of operation.

A radically new cotton-handling device, the SRRL opener takes cotton after it's broken from the bale, fluffs it to about 10 times its baled volume, then feeds it to standard cleaning equipment. Heavy trash is shaken out in the opener itself, and conventional cleaning gear can remove fine trash more efficiently from the opened lint. The machine also does an excellent job of "blending" cotton from different lots to produce smoother lint for spinning.

Demand for such a machine has grown in recent years. Cotton that is carefully handpicked poses no serious cleaning problem. But it's different with machine-harvested cotton—now well over 20 percent of the crop. Mechanical pickers, plus increased rough hand picking, have brought more and more trashy, hard-to-clean cotton to the mills.

So the new opener fills a real need. Two models are being made—one handling 2,000 pounds of lint an hour, the other 1,100 pounds. Two companies are now selling these machines. Seven other firms have been licensed by the Secretary of Agriculture to produce the opener free of royalty under a public service patent awarded to its SRRL inventors.

## How it looks - - - - - - - and how it works




OPENER is 10 feet high, requires about 6 x 8 feet of floor space. Cotton enters from left on lattice-type conveyor (A). Half-million individual teeth on five 12-inch gin-saw cylinders (B), running at 425 r. p. m., pluck tufts of cotton from main lint mass (C), also rotate mass upward. "Kicker" cylinder at top (D) keeps lint moving counterclockwise. Spiral rows of teeth on doffer cylinders (E) turn at about 930 r. p. m., remove cotton from saw cylinders. Slight air suction helps doffers feed lint into flues (F) and on to standard cleaning gear.

# What we know about DWARFISM

The destructive power of beef-cattle dwarfism, like that of an iceberg, is mostly hidden. What we can see—a fairly small number of dwarf calves—may not look dangerous. Yet beneath the surface lurks a natural force capable of great damage to this country's beef industry.

Fortunately, we know enough already about dwarfism to limit economic losses from it. And research has made a good start toward better control methods. One result is the profilometer, an instrument for detecting the slight forehead bulge that may mark normal-appearing animals as potential dwarf breeders.

Development of the profilometer followed the basic finding that dwarfism is inherited. It's not a disease, nor due to any fault of environment (such as deficient diet). Dwarf characteristics are transmitted by one or more recessive genes. This means that apparently normal cattle may still carry the gene and pass it on to some of their offspring. Also, animals that look normal are either carriers or dwarf free; there are no semicarriers or partly dwarf-free animals. And if both parents are carriers, one-fourth of their calves, on the average, will be dwarfs (see diagrams).

There is much we *don't* know about dwarfism. How many dwarf calves are produced each year? How many of our beef cattle are carriers? We still have no exact answers. Yet ranchers, stockmen, researchers, and others concerned do agree that dwarfs in both registered and commercial beef herds have been increasing. This can only mean a growing number of apparently normal animals that carry the dwarf gene—and may breed dwarfs. No major beef cattle breed or line of breeding is known to be dwarf free.

Surprisingly, there's evidence of a strong, inadvertent tendency toward selection of carrier animals for breeding purposes. It may be due to their slightly earlier maturity or possibly to a subtle influence of the dwarf gene on conformation.

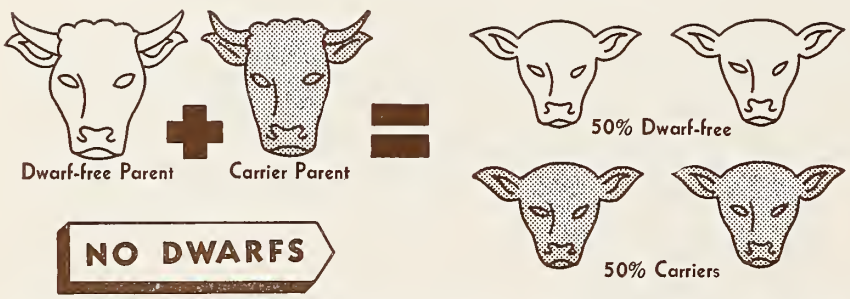
Ranchers fear dwarfism simply because it costs them money. A dwarf calf is practically worthless as a beef producer. It represents a loss of both the normal calf it might have been and the season's investment that was made in its mother.

What can a rancher do? His first step is to limit or stop, if possible, matings between carrier animals. So far, the surest way to find carriers is by slow and expensive breeding tests. If a dwarf is born, you can be certain both its parents are carriers. But it takes many matings to obtain satisfactory evidence that an animal is not a carrier.

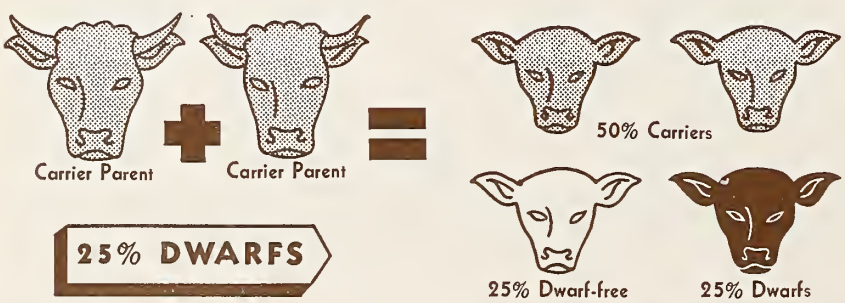
For a breeder to be sure 49 times out of 50 that an unproved bull is dwarf free, the bull must produce normal calves with no dwarfs when bred to 14 proved carrier cows or to 30 cows sired by a known carrier bull (half of which, theoretically, would be carriers).

A reliable shortcut to finding dwarf-free bulls is obviously needed. But its accuracy must still be checked by breeding tests. That's why cows that have borne dwarfs (proved carriers) are valuable. They should not be slaughtered but saved for use as test animals.

The profilometer is the only means now in sight that can help us to dis-




RECESSIVE GENE for dwarfism will result in production of dwarf calves only if both parents carry this characteristic. Carrier animals are found in all the major breeds of beef cattle.




AN AVERAGE of half the calves produced will be carriers if either of their parents has dwarf gene. Thus the carriers in a herd tend to multiply rapidly, increasing chance of dwarfs.

tinguish—with reasonable accuracy and without extensive breeding tests—between carrier and dwarf-free cattle. The instrument was conceived by P. W. Gregory of the California Agricultural Experiment Station. USDA and State workers and livestock-industry representatives are cooperating in trial use and further research on the profilometer.

This device is used to draw a profile outlining the shape of a bull's head on a line extending from between the ears to the nose. The profile is then analyzed to determine whether the bull carries the dwarf gene.

Abnormalities of dwarf calves—a broad, short face, bulging forehead, pot belly, stunted growth—indicate that dwarfism involves a deficiency of the pituitary and thyroid. These glands exert a profound influence on head shape. A carrier animal, though showing no other definite sign of recessive dwarfism, may still have a slight but measurable forehead bulge. This is the theory behind the profilometer's development.

Profilometer diagnoses of mature horned Hereford bulls in herds where dwarfism was known to occur, have identified the carrer bulls with few exceptions. Profiles are not yet reliable, however, for determining carriers among mature bulls of other breeds, or among younger bulls and cows. This does not mean that the profilometer is unsatisfactory. It does indicate the need for further study to determine the extent of usefulness of profiles.

The immediate research goal is not to make the profilometer 100-percent accurate, but to establish for it a reliable degree of accuracy—similar to that of breeding tests—that will make it practical for wider use. By keeping proved carrier cows, and by profiling and then carefully breed-testing their young bulls, cattle breeders can greatly aid researchers in bringing dwarfism under control.

DAIRY

# Weight by the INCH

Many an oldtimer recalls the girthing chain his grandfather used in buying, selling, and trading cattle. Scales were rarely available, and this device was the most reliable way he had of estimating body weight. Wrapped around a cow's heart girth—the forechest directly back of the front legs—the girthing chain indicated weight by means of markers spaced 6 inches apart.

Well, granddad had something. Figures from a recent study show that forechest circumference is more closely correlated with weight than any other body measurement. And this holds true at all ages.

Danish dairymen have long used such a guide. In fact, Americans probably based their girthing chains on data from Denmark. Owing to a difference in body type, however, Danish data have a tendency to overestimate the weight of U. S. cattle.

Figures to fit the American cow were compiled in 1936 by the Bureau of Dairy Industry. W. W. Swett was engaged in a long-time study on selection of cows for milk-producing ability (AGR. RES., Sept. 1953). In following the development of Holstein and Jersey cattle from 3 months to maturity, Swett had collected some 1,700 sets of actual weights and measurements from animals varying in age and size. J. F. Kendrick and J. B. Parker used these data to set up a table that shows estimated body weights for heart girths ranging in half-inch steps from 26 to 92 inches. Direct-reading tape measures based on that table have been provided to many farmers by their feed dealers.

Analysis of Swett's recently completed selection study confirms that heart girth is a good indicator of weight. He found no other measurement so consistently reliable.

The technique has even more uses today than a century ago, since few farms yet have scales. In buying, selling, classifying, judging, feeding, Dairy Herd Improvement Association testing, and sometimes in doing research, the modern version of the old girthing chain comes in handy.

# Lighting the way to More

THE THANKSGIVING TURKEY is welcome on dinner tables the year round. Unfortunately, though, he can't accept all his invitations. By nature, as well as tradition, he reaches good roasting size in autumn or early winter. Three-fourths of our turkey crop—which will total nearly 56 million birds this year—goes to market between Labor Day and Christmas.

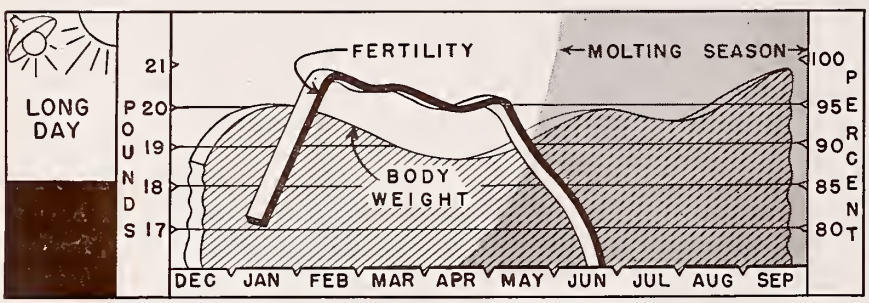
Growers need more turkey poults to raise for market in late winter, spring, and summer. Scientists at ARA's Beltsville poultry farm now find that proper use of light can help provide them.

Giving hens extra light to get more eggs sooner isn't new, of course. Turkey breeders use this method to obtain earlier poults. But a spring and summer decline in egg fertility, resulting in fewer turkeys later in the year, plagues many breeders. This premature drop in fertility and hatchability has occurred also at Beltsville.

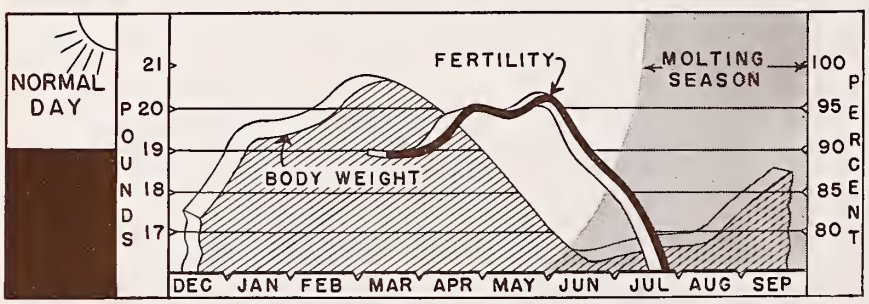
In the research-center breeding pens, electric lights go on early in December, lengthening winter days to a summerlike 14 hours. In 3 or 4 weeks the turkey hens begin laying (age: about 8 months). With sunlight alone, egg production usually doesn't start till early March.

Both hens and turkey males reach sexual maturity earlier under supplemental light. Breeding usually goes well the first few months. But soon—sometimes even in March or April—more and more eggs are found infertile. By June or July hatches of Beltsville Small White poults may be down to 50 percent or less of eggs laid.

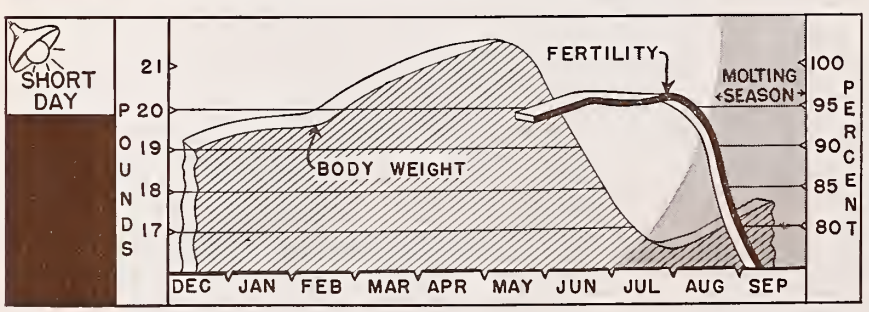
## How length of day affects the molting and fertility of turkey males




**14**-HOUR DAY, obtained using electric lamps to supplement sunlight during winter and spring, makes hens lay about 2 months sooner than they would otherwise. This lengthens breeding season in early months of the year. But Beltsville studies show that too-intense artificial light can cause premature molt in males. Sharp drop in body weight precedes molt, and decline in fertility follows. Effective breeding period usually ends by June.

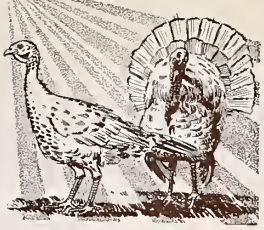



**11**-HOUR DAY is about the average provided by sunlight in early months of the year. With days of this length, turkey males usually don't molt until May. Their loss of fertility also occurs later. But since hens without artificial light do not begin laying before March, effective breeding period for turkeys on normal light-days may actually be shorter than for birds given supplemental light to increase effective day, as shown in chart above.




**8**-HOUR DAY, maintained artificially during first 5 months of the year, delays molting until near end of summer and prevents mid-season loss of male fertility. Turkey toms kept in reserve by this method must be segregated from other birds. Early breeding is done with males given same 14-hour day as hens. The short-day or "cold storage" males are put into the breeding pens about mid-May, after they are gradually acclimatized to the longer days.

# Turkeys



M. W. Olsen and S. J. Marsden of the Bureau of Animal Industry observed that molting (gradual loss and regrowth of feathers) was well advanced in the male birds when the decline in fertility began. The hens, however, kept their old plumage and stayed in good egg production.

The scientists knew that length of day influenced molt, just as it affects other changes in animals and plants (AGR. RES., May–June 1953). But what was the relation between light-day, molt, and turkey fertility?

In studies during the past 3 years, Olsen and Marsden found that too much early-season light directly causes early molt and loss of fertility in Beltsville Small White toms. Either long light-days or high light intensity, they discovered, can advance the onset of molt. Short days or less intense light postpone molting. Behavior of individual males varies widely, but in general their fertility declines rapidly after molting begins.

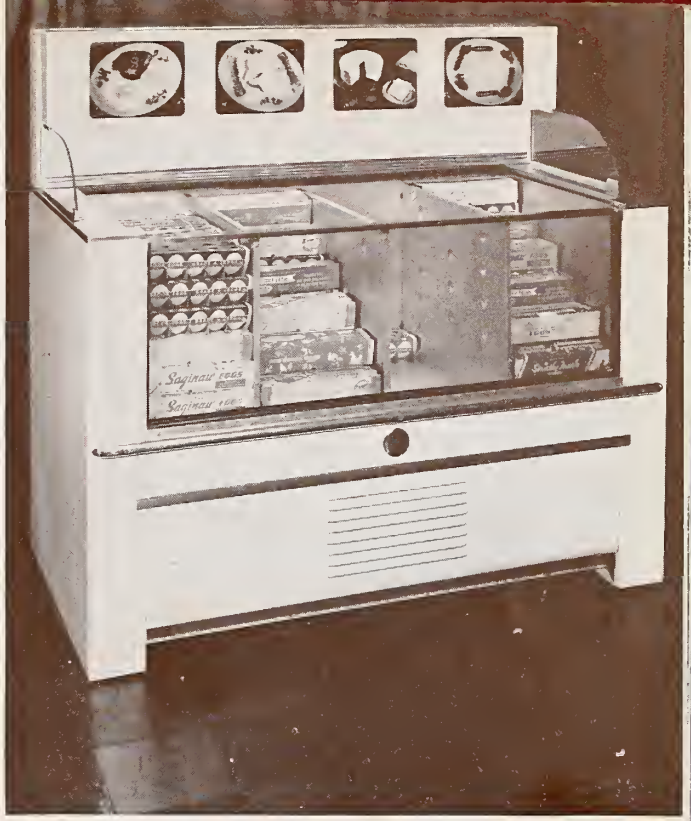
The researchers explain that light enters the turkey tom's eye, passes to the brain, and stimulates his pituitary gland, which in turn affects the thyroid. Hormones released by an overactive thyroid cause loss of weight and feathers, then diversion of body energies from sperm-cell production to growing new plumage. Light has much greater influence on molt in males than in hens.

The practical value of these findings is clear. It may be possible, for instance, with light of proper duration and intensity, to advance egg production in the hens without causing premature male infertility. Research on early-season lighting practices is continuing.

Another possibility also looks attractive. When turkey males are limited to an 8-hour, artificial light-day from December to April, their molt can be delayed until July or August. Therefore breeders may wish to hold some toms in sunless "cold storage" for later use.

Beginning in mid-April, these birds would be given gradually longer days (A too-abrupt change might bring on immediate molt.) Their fertility (low during the short-day period) comes up to normal and will hold well through the rest of the egg-laying season. About mid-May, these reserve toms are put in the breeding pens to replace males that are past their peak fertility.

Thus, with two shifts of males—and proper light use—turkey breeding might be extended successfully over 7 or 8 months (instead of the usual 4 or 5), and growers could supply tender young roasting turkeys for consumers' tables during more months in the year.



# It sells EGGS

A portable egg-display case (above), developed jointly by Cornell University and the Production and Marketing Administration, gives eggs more customer appeal. Marketing tests indicate that it can soon pay for itself in bigger sales.

In a retail store that normally sold about 272 dozen eggs a week, the new case helped move an extra 23 dozen, an increase of 8 percent. In a year, this could boost gross margin by $120, giving the retailer a 30-percent return on his investment. (An experimental commercial model of the case has been manufactured to sell for about $400.)

This type of display has several advantages: (1) uniform circulation of cold air helps maintain egg quality; (2) case can be made the right size to fit store's volume of sales and number of grades handled; (3) space is provided for promotional material on suggested egg dishes or how to use different grades of eggs; (4) case can be moved in the store as desired—for instance, to feature eggs alone or to display them with other items; and (5) it's easy to shift eggs already in the case to the front as more are added, so that those in first can be sold first.

# Forage crop Seeds Enou

IRRIGATION provides moisture for rapid growth. Bees (hives in background) pollinate legume crops.

DUSTING by airplane controls insects that attack legumes. Often, all farmers in one area grow seed of the same variety.

## In the Far West: Specialized seed production

HARVESTING, most other operations are mechanized. Dry climate is ideal for seed growing. Crop gets plenty of fertilizer.

ROW culture makes a little breeder seed go a long way, helps keep out weeds, volunteers.

TIMES are changing when it comes to forage cr Take 15 years ago. Few improved varieties had b developed, and the dribble of certified seed was ofte high priced that farmers wouldn't buy it. Then loo today. New grasses and legumes come out frequen and the seed supply of many of these superior pl amounts to millions of pounds.

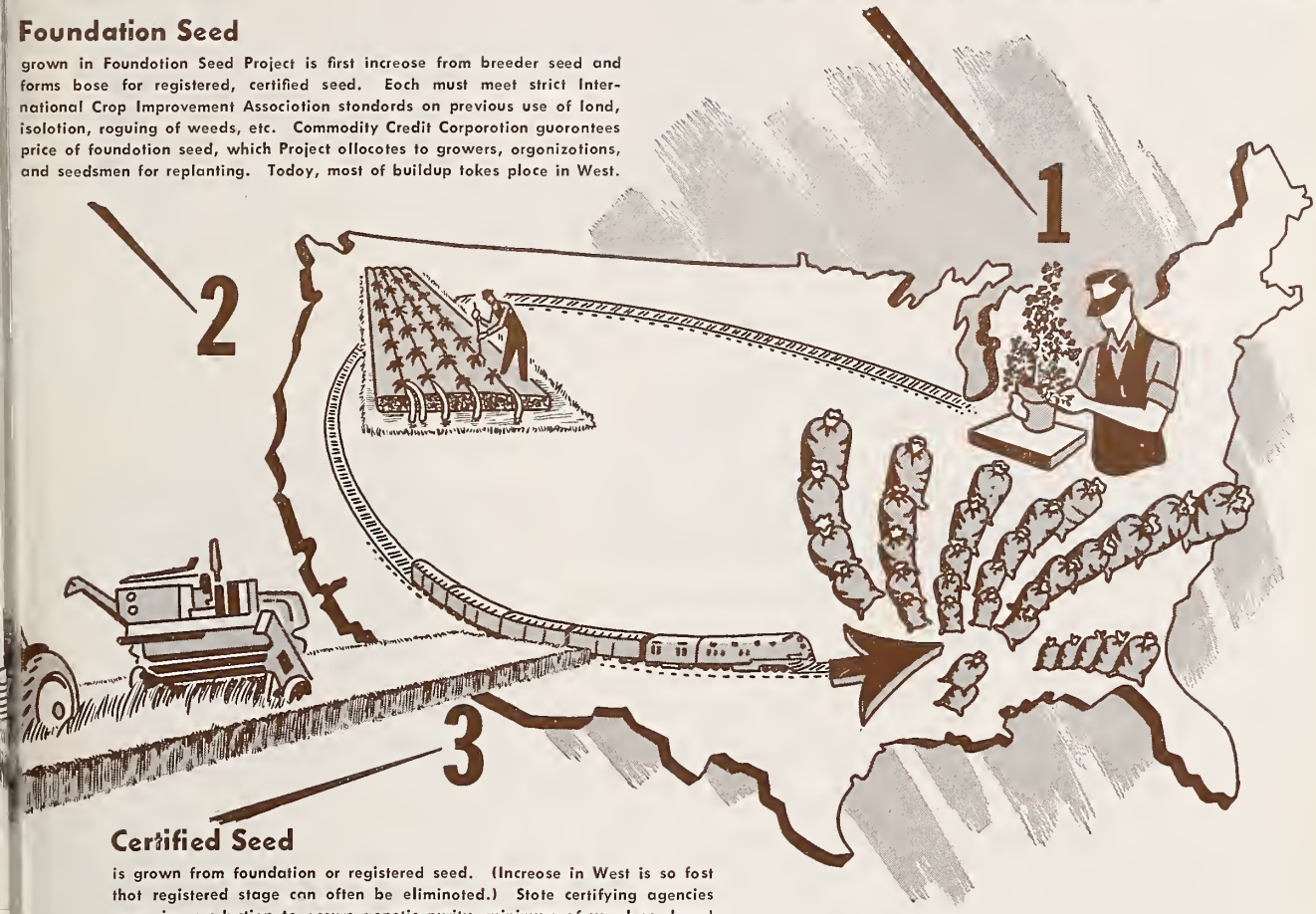
What happened? In the first place, we began appreciate the importance of the billion-acre grass that covers half the country. USDA and State exp ment stations put more scientists to work breeding b varieties and studying seed-production problems. S colleges, departments of agriculture, and crop impr ment associations followed up by expanding certifica services. With more certified seed being shipped f

**Breeder Seed**

of a new forage-crop variety is the fruit of years of research at a plant breeding station. Building this handful of pure parent stock to millions of pounds of certified seed for farmers is complex process. It often broke down before organization of the Foundation Seed Project, a cooperative effort of Federal and State agencies and seed trade. Stations must maintain flow of breeder seed to keep up the genetic purity of new varieties.

**Foundation Seed**

grown in Foundation Seed Project is first increase from breeder seed and forms base for registered, certified seed. Each must meet strict International Crop Improvement Association standards on previous use of land, isolation, roguing of weeds, etc. Commodity Credit Corporation guarantees price of foundation seed, which Project allocates to growers, organizations, and seedsmen for replanting. Today, most of buildup takes place in West.




**Certified Seed**

is grown from foundation or registered seed. (Increase in West is so fast that registered stage can often be eliminated.) State certifying agencies supervise production to assure genetic purity, minimum of weed seed and disease, high germination, careful cleaning, grading. Certified seed moves to farmers in regular seed-trade channels. With Foundation Seed Project in action, more seed of new varieties is now available than ever before.

ne State to another, the International Crop Improvement ssociation developed minimum standards to assure easonable uniformity.

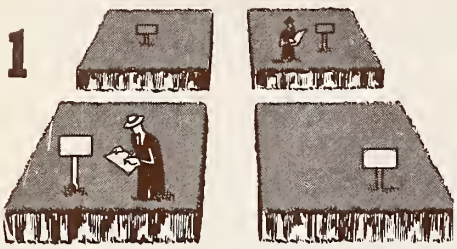
Even so, we still had a seed shortage in the East and Midwest. One difficulty was that seed could be certified nly when it was grown in the region to which a variety as adapted. (The object was to keep the variety true type. Northern alfalfa, for instance, loses in winter ardiness if grown for too long a time in a mild climate.) ut seed production in the East and Midwest is unpredictable. Bad weather—too dry or too wet—threatens nstantly. Furthermore, seed is usually a sideline and e crop may never be allowed to make seed in seasons hen hay or pasture happens to be short.

Then scientists opened the way to mass production of certified seed. They discovered that a limited number of generations in the specialized seed-growing areas of the West won't damage forage crops significantly. So certification standards were revised.

Still, farmers in the East and Midwest didn't see much of the new varieties bred for those regions. Usually, too little foundation seed was produced. And demand for seed was so great that much of the first increase—instead of being put back into the seed buildup—was siphoned off for growing hay and pasture.

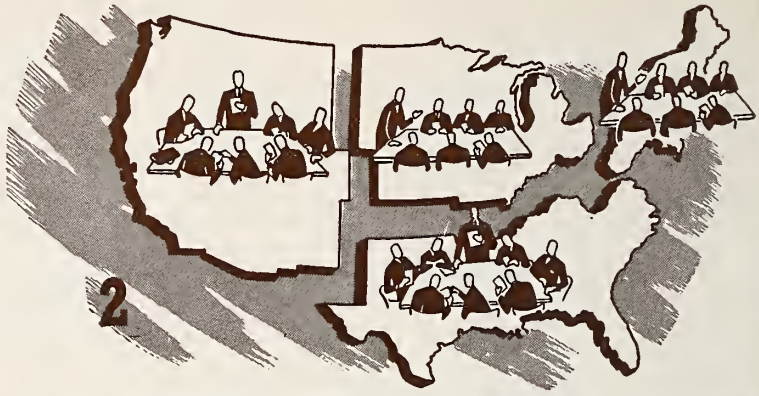
The break came in 1948 with the organization of the Foundation Seed Project. This cooperative effort has already gone a long way toward relieving the seed shortage of improved forage crops. In some cases, 30 to 40 times as much certified seed has been produced in half

## Foundation Seed Project is geared closely to forage-crop research:




**Breeders**

at experiment stations develop new varieties and determine areas to which they are best adapted.




**Regional Forage Crops Technical Committees**

recommend superior varieties for buildup by Foundation Seed Project, after testing and evaluation. Committees are made up of scientists from State experiment stations.


**16-member Foundation Seed Project Planning Conference**

is Foundation Seed Project's board of directors. Represented are four experiment station regions, International Crop Improvement Association, American Seed Trade Association, Production and Marketing Administration, and Bureau of Plant Industry, Soils, and Agricultural Engineering (two members each). Conference accepts varieties, determines production areas, estimates needs for breeder and foundation seed, allocates seed to states.


**State Foundation Seed Representatives**

are designated by State experiment stations to contract with growers for seed production and handle other Foundation Seed Project details.

the time required the old way. At present, 35 States are taking part in the Foundation Seed Project. C. S. Garrison, agriculturist at ARA's Plant Industry Station, serves as executive secretary.

The project is now building up 14 varieties. Here's a premilinary estimate on certified seed poundage for 1954 planting: ALFALFA—Ranger, 30,000,000; Buffalo, 10,000,000; Atlantic, 2,500,000; Narrangansett, 75,000; Vernal (added in 1953), no seed till 1955. RED CLOVER—Kenland, 2,500,000; Midland (made up of five lines), 100,000; Pennscott (added in 1952), 100,000. TIFT SUDANGRASS—150,000. CLIMAX LESPEDEZA—20,000.

The job doesn't end with quantity production. Many things can happen to forage crops: loss of purity through cross-pollination and volunteer plants; changes from environmental conditions; mechanical mixture in seeding, harvesting, or cleaning. So the Foundation Seed Project runs long-time trials to make sure superior genetic characteristics are being maintained through each step of seed increase for new forage-crop varieties.

## Seed stock of improved varieties can now be built up in short time:


**Nebraska Exp. Sta. released RANGER ALFALFA**


**RANGER Certified seed production was 1 million pounds**


**RANGER was included in new Foundation Seed Project**


**30 million pounds of RANGER for 1954**

## Consumers choose

# Bagged Cranberries

Cranberry growers are now marketing their first million-barrel crop. About 95 percent of this record production (a cranberry barrel holds 100 pounds) will be sold fresh in 1-pound packages. Buyer-preference studies made in the 1952–53 season show that most customers like to purchase cranberries in cellophane bags.

About half the cranberries sold last year were in bags and half were in cardboard boxes with transparent film windows. There are certain advantages in both containers, and the industry was undecided which to use. But marketing researchers got an answer last season in tests conducted by the Bureau of Agricultural Economics and the Farm Credit Administration. These tests showed that consumers preferred bagged cranberries 3 to 1 when given a choice between the two types of containers. Main reason given was that the berries could be seen better in bags.

Although both packages retailed at the same price, it cost 60 cents more per hundred pounds to pack cranberries in boxes. The marketing-research results, therefore, point the way to substantial savings for the cranberry industry.

Cranberries are as American as Thanksgiving. They were growing wild in Massachusetts when the Pilgrims landed, and the Indians liked to serve them with venison. Traditional with holiday meals, cranberries are becoming increasingly popular as a year-round delicacy.

Commercial production of this tart, red berry has doubled in the past 20 years. It's concentrated largely in 5 States: Massachusetts (which produces almost two-thirds of the crop), Wisconsin (where roughly a quarter of the total is grown), New Jersey, Washington, and Oregon.

# Chemical thinner for peaches

Thinning peaches by hand is expensive. Peach growers could substantially cut production costs if they had a reliable chemical thinner, such as those now used for apples.

New hope of solving this problem comes from recent tests of the growth modifier 3–Cl–IPC (3-chloro-isopropyl-N-phenyl carbamate). This is one of the carbamate chemicals, which are becoming important as weed killers but have not previously been tried for thinning fruit.

More research should be done before carbamates are used in commercial peach orchards. But results of two seasons work with 3-Cl-IPC are encouraging, say P. C. Marth, V. E. Prince, and A. L. Havis, of the Bureau of Plant Industry, Soils, and Agricultural Engineering.

Peach trees normally put out many blossoms. With no thinning, the grower may get a big crop of too-small peaches. Their weight can break tree limbs, and worms and rot may work between close-hanging fruits. Most growers knock off some blossoms or young fruit by hand, often using a piece of rubber hose on a stick. It's a time-consuming job.

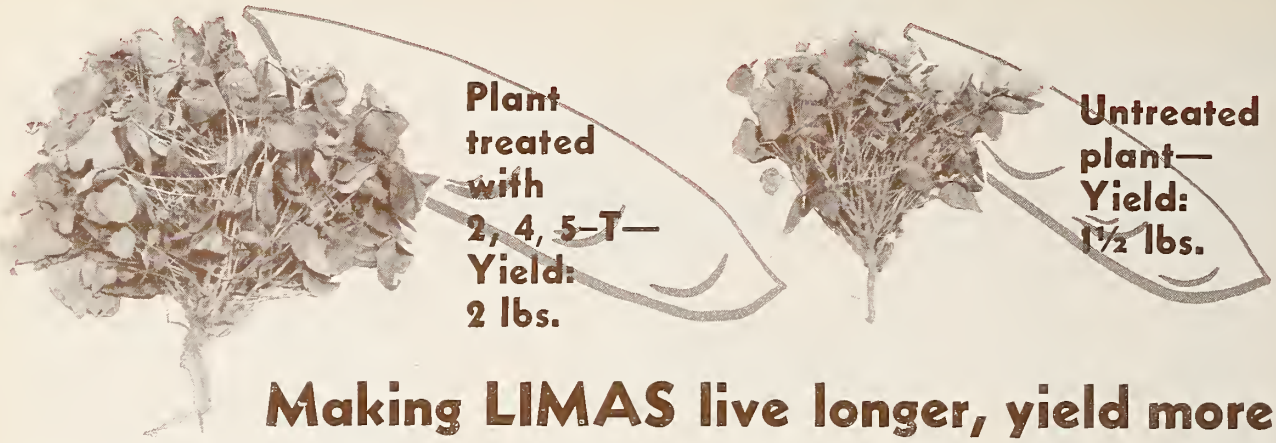
In limited tests of 3-Cl-IPC, ARA scientists sprayed this chemical on peach trees well after the fruit had formed. They got best results on the varieties Redhaven, Raritan Rose, and Triogem, with spray applied 30 days after full bloom. Treatments given 42 days after bloom also caused some thinning of peaches.

Effects of spraying usually show up within a week. Many young fruits stop growing and begin to shrivel. Some researchers think this may happen because carbamates upset the normal growth process in plants.

A simple spray treatment for post-bloom thinning is just what peach growers need. After the fruit is set, it's easy to see how much thinning should be done. Also, by this time there is little danger of further losses from frost.

Because 3-Cl-IPC evaporates readily, we must learn how temperature affects both evaporation and absorption by the plant. Also, since carbamates may affect growth, the stage of fruit development may greatly influence results.

Further experiments in the field are planned for next season at Federal and State experiment stations. This work should tell us more about using 3-Cl-IPC and other carbamates as fruit thinners.




# Making LIMAS live longer, yield more

Longer, more productive life for the lima bean may come from one of our deadliest weed killers, 2,4,5-T (2,4,5-trichlorophenoxyacetic acid).

At concentrations of 1,000 to 2,000 parts per million, this 2,4-D relative stops woody brush. Experimentally, at 20 to 40 p. p. m., it acts as a ripening spray for peaches and apples. Now, in exploratory research over several seasons at the Plant Industry Station, 2,4,5-T has been tried on Fordhook 242 bush limas. The compound was used at only 1 to 3 p. p. m. (at this rate, an acre could be treated with a quantity of chemical roughly equal to a single Fordhook bean). Such treatments delayed maturity about a month and raised bean yields as much as a third above normal.

Growers naturally are interested in heavy production. Although earliness is a common objective, lateness may be profitable if it's accompanied by a marked increase in yield.

P. C. Marth and R. E. Wester sprayed Fordhook limas with 2,4,5-T when the first blooms appeared. That treatment was repeated a week later. The plants dropped their flowers and made little additional growth for 20 to 30 days or even longer. Then came vigorous growth, resulting in bushy plants 2 or 3 times normal size. When frost didn't interfere, the sprayed beans produced from 18 to 35 percent more fruit than plants that were left untreated.

Removing the first flowers by hand increased yields by about the same amount. Apparently, deflowering allows the plant to build up its food-making capacity before starting to fruit. Unlike the chemical treatment, however, hand-thinning didn't interfere with growth. The plants developed naturally to regular size. This suggests that 2,4,5-T has a stimulating power on growth, aside from the effect of deflowering.

Liquid fertilizer, which included boron and other minor elements, was added to the spray on some plots. This gave no significant yield increase if the plants were well fed with ordinary fertilizer. At 3 p. p. m., however, 2,4,5-T stunted plants more drastically when the spray contained some liquid fertilizer. This seems to tie in with the finding that boron promotes absorption and translocation of 2,4-D (AGR. RES., Aug. 1953).

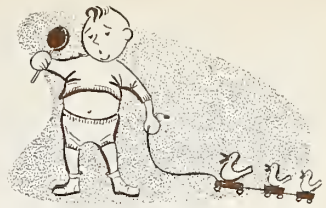
Several chemicals have shown ability to delay maturity of beans and other plants (AGR. RES., Sept. 1953). But none of these compounds stimulates growth and yield as 2,4,5-T does. It hasn't been tested on enough varieties and kinds of crops to permit generalizations about its action.

Researchers have a lot of work to do before they can recommend 2,4,5-T to bean raisers. But the method looks promising, and a number of States plan field trials for 1954.

## Meeting schedule is set for Research Advisory Committees

Annual meetings of the 22 USDA Research Advisory Committees are planned during the remainder of 1953 and the first quarter of 1954. Two committees have already met—Experiment Station Marketing Research on September 22–25 at Orono, Maine, and Forest Research on October 26–28 at Washington, D. C. Here's the calendar for the next 5 months. Except as noted, meetings will be held in Washington:

NOVEMBER: Food and Nutrition, 2–4; Wool, 12–13; DECEMBER: Production Economics, 7–9; JANUARY: Dry Beans and Peas, 4–6; Cold Storage, 6–8; Soils, Water, and Fertilizer, 11–13; Deciduous Fruit and Tree Nut, 18–21; Grain, 20–22; Oilseeds and Peanut, 25–27 (New Orleans, La.); FEBRUARY: Livestock, 1–3; Vegetable, 8–12; Seed, 10–12; Feed and Forage, 15–17; Dairy, 24–26; MARCH: Tobacco, 1–3 Rice, 3–5; Citrus, 8–10; Transportation, 17–19; Potato, 22–25; Poultry, 22–25 (Albany, Calif.); Sugar, 23–26 (Albany, Calif.); Cotton and Cottonseed, 31–APRIL 2. Attendance at meetings is restricted to committee members.



# Why do KNIT GOODS shrink?

It's not the yarn but the fabric's "loop geometry" that determines whether knitted garments will shrink or stretch when laundered.

This discovery by textile physicists of the Bureau of Human Nutrition and Home Economics can help in making knit fabrics that hold their shape through many washings.

In a study of knit goods made from cotton, rayon, acetate, or nylon, Bureau researchers Hazel M. Fletcher and S. Helen Roberts found that fabric stability depends mainly on the size and shape of loops made in knitting the yarn. It has usually been assumed that laundering caused changes in the length of yarn in knit fabrics. In this study, however, yarn in the fabrics tested was found to shrink or stretch very little.

Knitted fabrics are pulled lengthwise in the knitting process. If not properly relaxed in finishing, the final length and width of the knitted loops will not be in proper proportion, and garments made from the fabric will shrink or stretch out of shape. Expressed in more technical terms, if the length-width relationship of loops in the finished fabric can be plotted as a parabolic curve, the fabric won't shrink or stretch excessively when it is laundered.

On the basis of these findings, adjustments in the manufacturing process can be made as necessary to get properly shaped loops in the finished knit fabric.

## Production-control methods help make good pickles every time

Making pickles is fast becoming more of a science and less of an art.

Commercial formulas used in pickle manufacture have been handed down from packer to packer in much the same pinch-of-this-and-dab-of-that fashion as home recipes are passed from housewife to housewife. Adequate production-control measures were generally lacking.

But in recent years, as a result of fermentation research, pickling procedures have become more exact and reliable. One new advance is the development of a prediction chart that eliminates the rule-of-thumb methods formerly used to avoid yeast spoilage in making sweet pickles.

This chart was devised by J. L. Etchells and coworkers at the Raleigh (N. C.) laboratory of the Bureau of Agricultural and Industrial Chemistry, in cooperation with the North Carolina Experiment Station. Basis for the chart is a determination of the sugar and vinegar tolerances of some 35 yeasts known to cause spoilage in pickle manufacture.

Softening of cucumber salt-stock, which costs picklemakers about a million dollars a year, also appears on the way out. Researchers at Raleigh have developed practical methods to identify the softening agent (a pectin-splitting enzyme) in vat brines, and to determine its activity. Several large pickling firms and industry consulting laboratories are now making use of this control procedure.

## Checking liquid-egg quality is simplified by prefreezing test

It's cheaper and faster for the egg-breaking industry to sample liquid egg at the churn, where whole eggs are mixed before freezing, than to use samples drilled from the frozen product, which is the practice now in general use.

In a study of the new testing method, scientists of the Production and Marketing Administration found that samples of liquid egg taken at the churn were at least as satisfactory as drilled samples for determining total solids, fat and color content, and whipping properties (meringue-test value). They gave a more accurate measure of bacteriological and sanitary condition of the product than did drilled samples, and permitted test results to be known 72 hours earlier than was formerly possible.

The study also revealed that a direct microscopic count of bacteria in liquid egg is more reliable, rapid, and economical than the standard plate-culture method.

This improved test procedure, PMA researchers point out, provides more economical and effective quality-control procedures that are essential for the egg-breaking industry. It will aid in supplying the industry's customers—food manufacturers, bakers, other large-scale users of eggs—with a high-quality product at relatively low cost.

The study in which the new method was developed is reported in *An Analysis of Quality in Commercial Egg Products*, available from the Production and Marketing Administration, USDA, Washington 25, D. C.

HEAT is everywhere. Earth, water, air—even in wintertime—contain some heat. And engineers have learned to move it from one place to another with a rather simple machine called a heat pump.

That sounds like a farm helper. Sometimes we *want* heat—to make the house comfortable in winter, to warm water, or to dry grain. Sometimes we want to *get rid* of heat—to make the house comfortable in summer, to freeze food, or to cool milk. The heat pump can do either of these jobs, or both. And in some cases it even does both at the same time.

The household refrigerator unit is a form of heat pump. It picks up the small quantity of heat in the food compartment (at a low temperature) and disposes of that heat in the room air (at a higher temperature). Heat pumps do much the same thing.

A great deal of research effort has been given to the heat pump in recent years. Manufacturers, utility companies, and public agencies have all contributed.

Most advanced are unts to furnish both heating and cooling for homes and other structures. This unit, of course, needs a source of heat in cold weather and a place to dump heat in warm weather. Earth, water, and air are all being tried as a heat source-sink.

At present, such systems are likely to be most satisfactory in milder climates where temperature rarely has to be raised more than 30° to 40° F. Cooling is no problem since the peak need doesn't exceed a 10° drop in any area. Several units, both air and water types, are now on the market.

The heat pump may be able to do a number of other farm jobs. Some of the possibilities are illustrated.

ARA research on heat pumps is being carried on at Manhattan, Kans., in cooperation with the Agricultural and Engineering Experiment Stations of Kansas State College. Work has been done on both earth and water as a heat source-sink; on heat pumps for water heating and grain drying; and on the nature of the load that wide use of heat pumps would impose on powerlines. It's still too early, however, for practical recommendations.

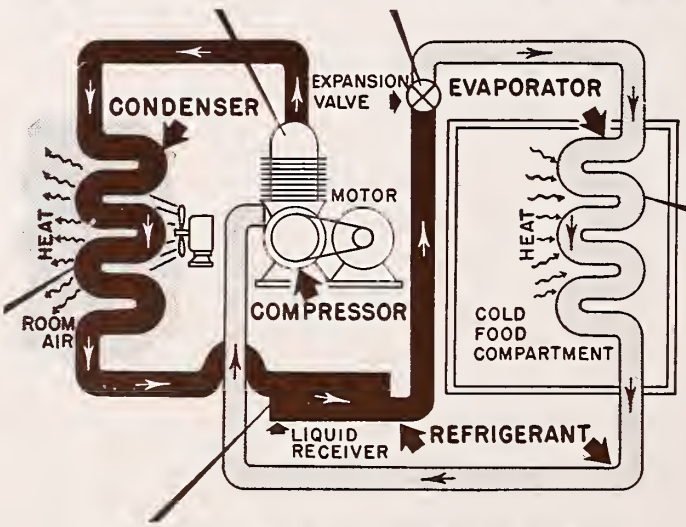
Main drawback with many systems now is high initial cost. This may be overcome by increasing interest in the manufacture and use of heat pumps, plus continuing research to improve their performance and efficiency.

# Researchers are working on *Heat*

## One type of heat pump: the refrigerator

**4.** Carrying heat fram faad campartment, gaseous refrigerant enters campressar. This pump puts refrigerant under high pressure again. Mare heat is added ta gas by campressian pracess and pressure-raising wark dane by motar.

**2.** Pressure an refrigerant drops abruptly as it passes thraugh the expansion valve.

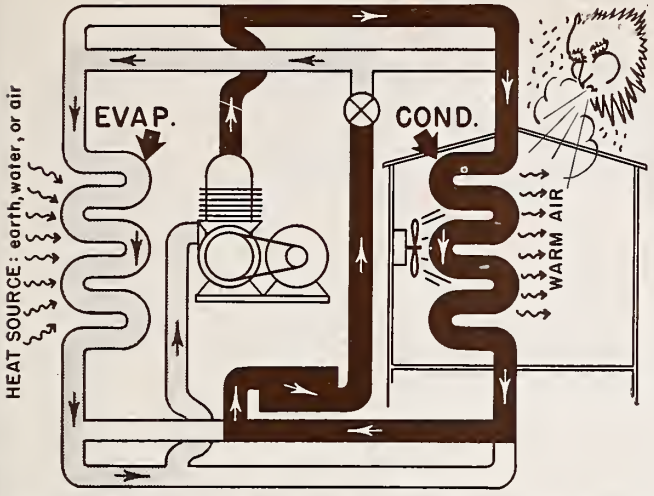


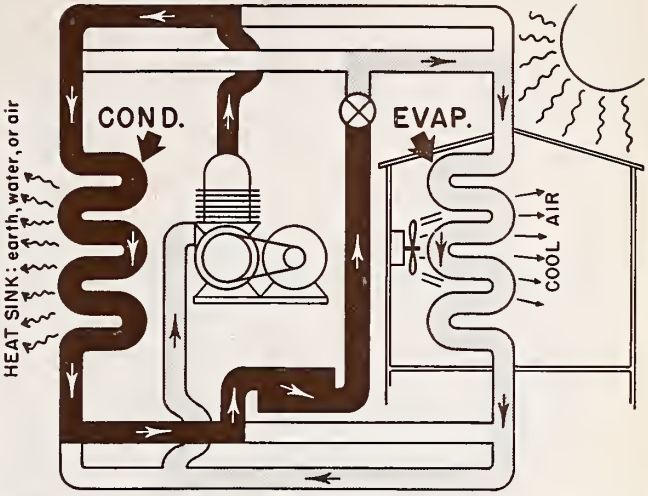

**5.** Refrigerant reaches candenser coil in gas farm with temperature and pressure high. But air blawing aver cail carries away heat. Now, at high pressure and low temperature, refrigerant turns back inta liquid. It maves to liquid receiver ta start another cycle.

**3.** With pressure reduced, refrigerant starts ta bail. Bailing takes heat. Sa refrigerant picks up heat from air araund evaporator cail, thereby caaling faad campartment. Law pressure and the heat taken in change refrigerant ta gas by the time it passes through evaporator.

**1.** Refrigerant is a gas at raam temperature and atmaspheric pressure, a liquid at law temperature and high pressure. Thus, it bails at much lawer temperature than water. Liquid receiver is a tank far temparary starage of refrigerant. Being under high pressure at this point, refrigerant goes to expansian valve in liquid form.

## Home heat pump: cold-weather heating . . . warm-weather cooling

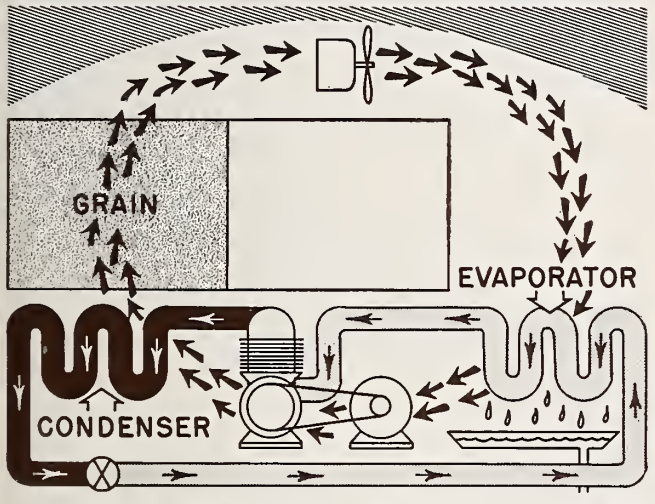



When system switches from one use to the other, valves (not shown) reverse flow of refrigerant. Evaporator and condenser trade jobs. System is clean, safe, automatic, compact, eliminates fuel handling. Much research is being done on heat source-stinks: (1) *Earth* has possibilities, since its temperature is constant at about 6 feet or deeper. But moving heat to or from the soil is difficult because it's a poor conductor under some conditions. Several hundred feet of buried piping may be required. (2) *Water* works fine, but the system would use thousands of gallons daily in cold weather. Well drilling, pumping would add to cost. (3) *Air* is plentiful, yet its temperature is lowest when need for heat is greatest. Supplemental heat (electricity, sun energy, or chemical storage) may prove to be necessary.

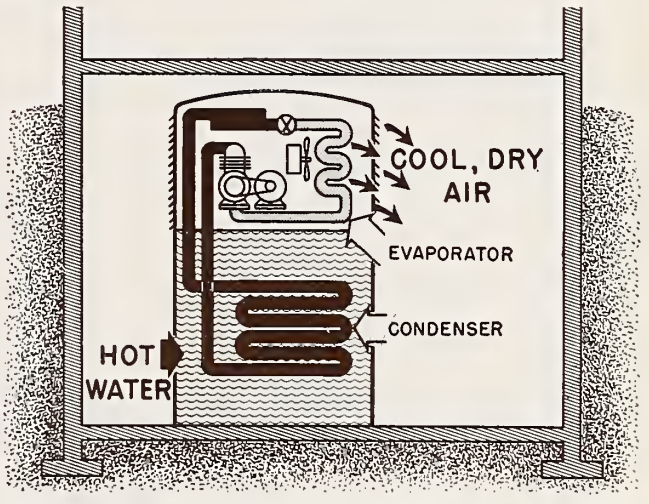
# *Pumps* for the farm

## Curing, storing farm crops




Heat pump is well suited to this use. When moist air passes over the cold evaporator, moisture condenses and drains or freezes out. Air then picks up heat from motor, compressor, condenser coil. This warm, dehumidified air can remove much more moisture from grain than outside air at the same temperature. Humidity, temperature can be regulated to avoid overdrying in the lower layers of grain.

## Doing two jobs at one time




Two-job heat pumps show promise. One type heats water, also cools and dehumidifies a basement or utility room during warm weather. Doing both costs less than ordinary electric water-heating. Studies have been made on a heat pump that warms dairy water at the same time it cools milk. ARA engineers plan experimental unit to condition potato and onion storages and provide heat for sorting rooms.

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# AGRISEARCH Notes

## Two pests gang up on cotton

Cotton varieties supposedly resistant to fusarium wilt may succumb to this fungus if they are also attacked by the sting nematode.

T. W. Graham, of the Bureau of Plant Industry, Soils, and Agricultural Engineering, and Q. L. Holderman, of the South Carolina Agricultural Experiment Station, have discovered that tiny holes pierced in cotton rootlets by the sting nematode allow the wilt fungus to enter plants considered wilt resistant.

They also found that cotton varieties not resistant to wilt had a low incidence of the disease when sting nematodes were not present.

## For faster plant breeding

A time-saving way to select wild plants for breeding stock has been developed by E. E. Clayton of ARA's Plant Industry Station.

He uses it, in creating disease-resistant tobacco varieties, to determine whether a given wild plant, distantly related to our cultivated tobaccos, will prove useful as a source of plant-disease resistance. The wild plant is crossed with a disease-susceptible crop tobacco, and the cross is inoculated to test it against a particular disease.

If this cross shows good resistance, its wild-plant parent is likely to prove valuable for breeding work as a source of the resistance. But if resistance in the test cross is low, the wild plant—even though highly resistant itself—is probably not suitable genetically for use in making new disease-resistant varieties for cultivation.

Plants that carry disease resistance—or other desired qualities—in a single gene (monogenic) can be used much more successfully for breeding purposes than plants that are polygenic for the wanted characteristic—that is, carry it in more than one gene.

Clayton believes that his technique, which helps identify plants that are monogenic for tobacco-disease resistance, may also permit rapid testing of wild plants with other desirable qualities of value in breeding improved varieties of many crops.

## Prepress-solvent process pays

Cottonseed oil mills of the prepress-solvent type usually return larger profits per ton of seed crushed. This was concluded from an extensive USDA-State-industry study of the four major types of mills.

In the prepress-solvent process, much of the oil is pressed from the cottonseed, and the rest is extracted with a chemical solvent. Mills of this type last year produced about 7 percent of our cottonseed oil.

At present, about 85 percent of all cottonseed crushed in this country is handled by hydraulic- and screw-press mills, while roughly half the remainder is processed by the direct-solvent method.

Although the prepress-solvent process was found generally more profitable (by $2 to $5 per ton of seed crushed), it does not follow that all operators should convert to this type mill. Condition of present plant, amount of seed locally available, and other factors help determine whether a change would pay.

The researchers did calculate, however, that an industry-wide shift to prepress-solvent mills would (1) increase the supply of cottonseed oil by at least 10 percent, (2) raise total farm value of cottonseed sold by growers about 8 percent, and (3) reduce cottonseed oil prices to consumers almost 9 percent.

A report of the study is available from USDA's Production and Marketing Administration.



U. S. GOVERNMENT PRINTING OFFICE: 1953